

# ePHENIX Cost Overview

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# ASSUMPTIONS AND METHODOLOGY

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- ePHENIX is based on sPHENIX
  - BaBar solenoid
  - EMCAL
  - HCAL
  - Tracking
- You are not being asked to evaluate sPHENIX, only the additions we are considering for eRHIC

- We have attempted to estimate costs in a way consistent with what has been done so far for eRHIC
  - Equipment costs in FY12\$ without inflation
  - Overhead rates only adjusted slightly for different departmental burdens
  - Conversion from Euros at \$1.25/€

- Labor costs estimated by mid-level physicists, engineers, and technicians
- Brookhaven direct costs and overheads
- 3% annual inflation rate

# COSTS

1/10/2014



- Cost tables
  - 4.1: Equipment costs
  - 4.2: Labor costs
- Ten new subsystems + electronics
  1. Endcap crystal calorimeter
  2. Forward EMCAL
  3. Forward HCAL
  4. TPC
  5. GEM trackers
  6. DIRC
  7. RICH
  8. Aerogel
  9. Roman pots
  10. Beam-beam counters
  11. Electronics

## Example of equipment costs

| System               |                             | Cost (M\$)  | Overhead (M\$) | Contingency (M\$) | Total (M\$) |
|----------------------|-----------------------------|-------------|----------------|-------------------|-------------|
| Endcap Crystal EMCAL | Crystals                    | 2.70        | 0.29           | 1.50              | 4.49        |
|                      | Support structure           | 0.50        | 0.13           | 0.31              | 0.94        |
|                      | Calibration system          | 0.20        | 0.05           | 0.13              | 0.38        |
|                      | <b>Total</b>                | <b>3.40</b> | <b>0.47</b>    | <b>1.93</b>       | <b>5.80</b> |
| Forward EMCAL        | Pb-Scintillator calorimeter | 0.71        | 0.10           | 0.40              | 1.21        |
|                      | Support structure           | 0.50        | 0.13           | 0.31              | 0.94        |
|                      | Calibration system          | 0.20        | 0.05           | 0.13              | 0.38        |
|                      | <b>Total</b>                | <b>1.41</b> | <b>0.27</b>    | <b>0.84</b>       | <b>2.53</b> |



## Example of labor costs

| System                      | FY21    | FY22    | FY23    | FY24     | Total FTE | Total     |
|-----------------------------|---------|---------|---------|----------|-----------|-----------|
| <b>ENDCAP Crystal EMCAL</b> |         |         |         |          |           |           |
| Physicist FTE               | 1.00    | 1.00    | 1.00    | 2.00     | 5.00      |           |
| Physicist                   | 237,440 | 244,563 | 251,900 | 518,914  |           |           |
| Physicist overhead          | 80,255  | 82,662  | 85,142  | 175,393  |           |           |
| Physicist total             | 317,695 | 327,226 | 337,042 | 694,307  |           | 1,676,270 |
| Engineer FTE                | 1.00    | 1.00    | 0.50    | 0.25     | 2.75      |           |
| Engineer                    | 203,549 | 209,655 | 107,972 | 55,606   |           |           |
| Engineer overhead           | 68,799  | 70,863  | 36,495  | 18,795   |           |           |
| Engineer total              | 272,348 | 280,518 | 144,467 | 74,400   |           | 771,734   |
| Technician FTE              | 0.00    | 0.00    | 1.00    | 2.00     | 3.00      |           |
| Technician                  | 0       | 0       | 163,231 | 336,256  |           |           |
| Technician overhead         | 0       | 0       | 55,172  | 113,655  |           |           |
| Technician total            | 0       | 0       | 218,403 | 449,911  |           | 668,315   |
| Total FTE                   | 2.00    | 2.00    | 2.50    | 4.25     | 10.75     |           |
|                             |         |         |         | 1,218,61 |           |           |
| Total labor                 | 590,043 | 607,744 | 699,913 | 9        |           | 3,116,318 |

- **Total equipment costs**

- Cost: \$41.94M
- Overhead: \$8.08M
- Contingency: \$25.01M
- Total: \$75.02M

# Labor costs

| System               |                         | FY21             | FY22             | FY23             | FY24              | Total FTE     | Total             |
|----------------------|-------------------------|------------------|------------------|------------------|-------------------|---------------|-------------------|
| <b>ePHENIX Labor</b> |                         |                  |                  |                  |                   |               |                   |
|                      | Physicist FTE           | 9.50             | 8.50             | 10.25            | 13.25             | 41.50         |                   |
|                      | Physicist               | 2,255,680        | 2,078,787        | 2,581,976        | 3,437,807         |               |                   |
|                      | Physicist overhead      | 762,420          | 702,630          | 872,708          | 1,161,979         |               |                   |
|                      | <b>Physicist total</b>  | <b>3,018,100</b> | <b>2,781,417</b> | <b>3,454,684</b> | <b>4,599,785</b>  |               | <b>13,853,987</b> |
|                      | Engineer FTE            | 9.50             | 9.50             | 7.00             | 5.00              | 31.00         |                   |
|                      | Engineer                | 1,933,711        | 1,991,722        | 1,511,612        | 1,112,115         |               |                   |
|                      | Engineer overhead       | 653,594          | 673,202          | 510,925          | 375,895           |               |                   |
|                      | <b>Engineer total</b>   | <b>2,587,305</b> | <b>2,664,925</b> | <b>2,022,537</b> | <b>1,488,010</b>  |               | <b>8,762,777</b>  |
|                      | Technician FTE          | 1.00             | 1.00             | 10.50            | 18.50             | 31.00         |                   |
|                      | Technician              | 153,861          | 158,477          | 1,713,928        | 3,110,372         |               |                   |
|                      | Technician overhead     | 52,005           | 53,565           | 579,308          | 1,051,306         |               |                   |
|                      | <b>Technician total</b> | <b>205,866</b>   | <b>212,042</b>   | <b>2,293,236</b> | <b>4,161,677</b>  |               | <b>6,872,822</b>  |
|                      | <b>Total FTE</b>        | <b>20.00</b>     | <b>19.00</b>     | <b>27.75</b>     | <b>36.75</b>      | <b>103.50</b> |                   |
|                      | <b>Total labor</b>      | <b>5,811,272</b> | <b>5,658,384</b> | <b>7,770,458</b> | <b>10,249,473</b> |               | <b>29,489,586</b> |

Next: Craig Woody will go over the details of how we evaluated the equipment costs